GEOLOGICAL SURVEY OF CANADA
DEPARTMENT OF MINES AND TECHNICAL SURVEYS

PRELIMINARY SERIES

SHEET 93 J

Adjoins Map 11-1961, "Pine Pass"

Adjoins Map 630A, "Fort Fraser" (East Half)

Adjoins Map 49-1960, "Prince George"

PUBLISHED, 1962

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LEGEND

CENOZOIC

QUATERNARY
PLEISTOCENE AND RECENT

20	Till, gravel, sand, clay, and silt

TERTIARY
MIOCENE AND/OR LATER
ENDAKO GROUP

19	Basalt, andesite, related tuffs and breccias

PALEOCENE (?) TO MIOCENE

18	Conglomerate, sandstone, mudstone, and lignite; 18a, may be older than 17

PALEOCENE (?) TO MIOCENE (?)

17	Rhyolite, dacite; 17a, related dykes; 17b, may be intrusive

PRE-TERTIARY FORMATIONS WEST OF McLEOD LAKE FAULT

MESOZOIC

JURASSIC OR CRETACEOUS

16	Gneissic quartz diorite and granodiorite

TRIASSIC AND/OR JURASSIC
UPPER TRIASSIC AND/OR LOWER JURASSIC
TAKLA GROUP

15	Andesitic and basaltic flows, tuffs, and breccias; 15a, conglomerate, greywacke, argillite, and limestone

PALAEOZOIC

PENNSYLVANIAN (?) AND PERMIAN
CACHE CREEK GROUP (12,13)

12 13	12. Limestone, ribbon chert, argillite 13. Basaltic and andesitic flows, tuffs, and breccias; minor chert and argillite

MISSISSIPPIAN (?)

11	MOUNT MURRAY INTRUSIONS: diabase, diorite

SLIDE MOUNTAIN GROUP (9,10)

9 10	9. Basaltic pillow lavas, andesite, related pyroclastic rocks, argillite, chert, greywacke 10. Limestone

CAMBRIAN AND/OR LATER
LOWER CAMBRIAN AND/OR LATER
CARIBOO GROUP (7,8)

7 8	8. SNOWSHOE FORMATION: grey micaceous quartzite, phyllitic quartzite, phyllite; includes minor pegmatite of A 7. MIDAS FORMATION: black quartzose phyllite, argillite

WOLVERINE COMPLEX

A	Granodiorite, granite, pegmatite
B	Granitoid gneiss, micaceous, garnetiferous, and chloritic schists, pegmatite, and small bodies of granodiorite; minor feldspathized quartzite

PRE-TERTIARY FORMATIONS EAST OF McLEOD LAKE FAULT

MESOZOIC

TRIASSIC (?) AND/OR JURASSIC (?)

14	Argillite, greywacke, shaly limestone; minor andesite and basalt

PALAEOZOIC

DEVONIAN AND (?) LATER
MIDDLE DEVONIAN AND (?) LATER

6	Limestone, silty and shaly limestone

ORDOVICIAN AND SILURIAN
UPPER ORDOVICIAN TO MIDDLE SILURIAN

5	Limestone, dolomite; quartzitic, calcareous, and dolomitic sandstone

CAMBRIAN
MIDDLE (?) AND UPPER CAMBRIAN

4	Limestone, silty limestone, calcareous siltstone, calcareous schist

CAMBRIAN AND (?) EARLIER
LOWER CAMBRIAN AND (?) EARLIER

3	Dolomite, limestone, quartzite, and sandy dolomite; black and green slate

PROTEROZOIC

CAMBRIAN AND/OR EARLIER
LOWER CAMBRIAN AND/OR EARLIER

2	Black slate, slaty greywacke; minor quartzite, conglomerate, greywacke
1	Chlorite and sericite schist, phyllite, schistose grit, and quartz-pebble conglomerate

Geological boundary (approximate)

Bedding, tops known (horizontal, inclined, vertical)

Bedding, tops unknown (inclined, vertical)

Schistosity, gneissosity (inclined, vertical, dip unknown)

Fault (defined, approximate, assumed)

Anticline (defined, approximate)

Syncline (defined, approximate)

Glacial striae

Fossil locality

Mineral occurrence . . . X Au

MINERAL SYMBOLS

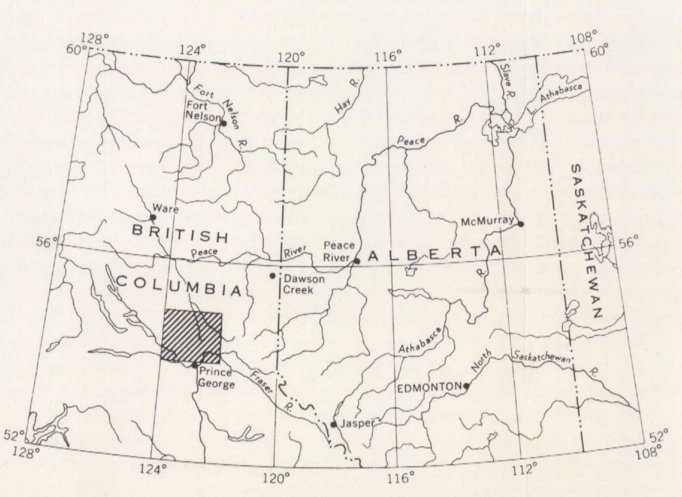
Copper	Cu	Mercury	Hg
Gold	Au	Molybdenum	Mo
Lead	Pb	Tungsten	W
Magnesium	Mg	Zinc	Zn

Geology west of McLeod Lake fault by J. E. Armstrong, H. W. Tipper, and J. W. Hoadley, 1946; H. W. Tipper, 1961. Geology east of McLeod Lake fault by J. E. Muller, 1961

Descriptive notes by J. E. Muller and H. W. Tipper

Cartography by the Geological Survey of Canada, 1962

Mean magnetic declination, 26°50' East, decreasing 3.7' annually. Readings vary from 26°33' in the SW corner to 27°27' in the NE corner of the map-area



MAP 2-1962

GEOLOGY

McLEOD LAKE

BRITISH COLUMBIA

Scale: One Inch to Four Miles = $\frac{1}{253,440}$

Miles

4 2 0 4 8 12

COPIES OF THIS MAP MAY BE OBTAINED FROM THE DIRECTOR, GEOLOGICAL SURVEY OF CANADA, OTTAWA

LEGEND

Roads, hard surface, all weather

Road, dry weather

Cart track

Trail

Railway

Indian Reserve boundary

Intermittent stream

Marsh

Contours (interval 500 feet) . . . 5000

Depression contour

Height in feet above mean sea-level . . . 4990

Base-map by the Army Survey Establishment, R. C. E., Department of National Defence, 1959

DESCRIPTIVE NOTES

Much of the southern and central parts of the map-area are accessible by highways, railways, and roads. Most of the northwest quarter and the mountains east of Parsnip River cannot be reached by motor vehicle. Parsnip, Crooked, Fraser, and Stuart Rivers are navigable by small boats. Numerous lakes provide landing areas for float-equipped aircraft. Helicopter landings are restricted by brush, timber, and windfall, except above 5,000 feet elevation.

Bedrock is best exposed in the mountains northeast of Parsnip River; elsewhere a few outcrops are found on hilltops, along some creeks and rivers, and in railway- and road-cuts. Glacial deposits are widespread; their depth may be 300 to 400 feet in major valleys, but elsewhere is probably less than 25 feet.

The schists (1,2) are divided in two units, with gradational contact: unit 1 is characterized by schistose quartz-grit, conglomerate and green chlorite schist; the upper one (2) is mainly dark-coloured slaty argillite and quartzite. North of the map-area the upper unit (2) is at least 3,500 feet thick; unit 1 may be of similar thickness.

Unit 3, in gradational contact with unit 2, is marked by several zones of light-brown and reddish-weathering, commonly quartzose dolomite and limestone, but quartzite and slate predominate. North of the map-area, where the unit is at least 1,700 feet thick, the carbonate rocks contain Lower Cambrian archeocyathids. Unit 3 is thus correlative to the lower part of the Cariboo Group in Cariboo Mountains[1]; two recently recognized clastic formations below that group resemble units 1 and 2[2].

The Palaeozoic section (4-6) between Parsnip and Crooked Rivers is poorly exposed and imperfectly known. Unit 4 is mainly limestone—massive and brecciated or with nodular carbonate-silt interbanding. Bedding is commonly obscured by schistosity oblique to it. Scant fossil collections indicate a late Cambrian to early Ordovician age. Limestone, dolomite, and calcareous sandstone of unit 5 contain coral faunas indicative of late Ordovician (Richmond) and early Silurian (Clinton) age. Graptolite-bearing calcareous shale and siltstone of Clinton age also occur. Shaly and silty limestone (6) with Middle Devonian fossils occurs in two places in contact with quartzite of probable Silurian age.

The Wolverine Complex (A,B) is believed to consist of metamorphosed and granitized Cariboo Group rocks (7,8) but may include older and younger strata. The time of metamorphism and granitization was post-Lower Cambrian, possibly in part as late as Mesozoic. Unit B includes small areas of Cariboo Group quartzites and, conversely, unit 8 includes small bodies of granodiorite and gneisses.

No relationship has been established yet between post-Lower Cambrian strata east and west of McLeod Lake fault. Units 7 and 8 are interpreted as part of a belt of Cariboo Group rocks trending northwest from the type area[1].

The Slide Mountain Group (9,10) is characterized by basaltic pillow lavas, thus distinguishing it from the less-volcanic Cache Creek Group (12,13). The limestone (10) forms one band 200 to 300 feet thick interbedded with the volcanic rocks. Crinoidal fragments are present.

The Mount Murray Intrusions (11) form sills and dykes in the Slide Mountain Group volcanic rocks (9), and are restricted to these rocks in this map-area. It has been suggested that they are genetically related to the Mississippian(?) volcanic rocks[1].

The Cache Creek Group of central British Columbia consists of a very thick assemblage of interbedded sedimentary and volcanic rocks, mainly of Permian age. Foraminiferal limestones and ribbon cherts are characteristic of the group. In this map-area units 12 and 13 comprise rocks in direct continuation of a belt of Cache Creek rocks to the northwest. Scattered outcrops in the adjoining area[3] indicate a southeast continuation of this belt.

East of Crooked River two belts of dark sediments with minor volcanic rocks (14) may be of Mesozoic age. These are best exposed in a small canyon south of Tacheeda Lake.

The Takla Group (15) in this area is mainly Lower Jurassic basic lavas and pyroclastic rocks, but scattered outcrops of sediments (15a) in the southern part are probably Upper Triassic. As fossils have been found, correlation is based on lithologic similarity to fossiliferous strata of adjoining areas.

The intrusive rocks (16) are younger than the Takla Group volcanic rocks (15) and may be related to the Omineca Intrusions to the northwest.

The rhyolite and dacite (17) are fresh rocks like the Eocene-Oligocene rhyolitic rocks to the south and west. Related dykes (17a) are present on Mount Mackinnon and many others not shown also cut the Wolverine Complex (B).

Paleocene(?) to Miocene sedimentary rocks (18) are poorly consolidated and for the most part represent late Tertiary channels of Fraser River and its tributaries[4]. Lithic sandstone, shale with leaf imprints, and angular conglomerate that bears schist limestone, and quartz pebbles (18a) occur unconformably on highly folded schists and are exposed in the railway-cut along Reynolds Creek. These may be correlative to Paleocene beds identified along Parsnip River in Pine Pass area, and perhaps underlie a part of that valley.

The Endako Group (19) is poorly exposed in this area but elsewhere in central British Columbia it forms extensive lava plateaux. The group is essentially undeformed and probably underlies much of the low country around Great Beaver Lake and northward and eastward to Salmon and Carp Lakes. In this area the group has a maximum thickness of less than 1,000 feet—for the most part not more than 200 feet.

Numerous well-developed drumlins, eskers, and meltwater channels clearly indicate that the last ice-movement across the area was from southwest to northeast, varying from N70° E in the south to N25° E in the north. In the valley of Salmon River, south of Summit Lake, two tills are exposed, probably representing two glacial advances.

The McLeod Lake fault is the outstanding structural feature of the map-area, separating the rock sequence of central British Columbia on the west from the Rocky Mountain sequence on the east. To the north, in Pine Pass map-area[5], it continues along the western edge of the Rocky Mountain Trench. To the southeast the fault splits into two; one may continue along Fraser River, the other may lose its identity in the Cariboo Mountain structural complex.

The McLeod Lake fault intersects structures of the Palaeozoic-Mesozoic assemblage to the east. These structures are undoubtedly more complex than shown but a tentative interpretation of the outcrop pattern suggests the presence of several west-dipping folded thrust blocks. Another major fault probably follows the southwest side of Parsnip Valley and continues along Otter Creek. In the north it may bring Cambrian rocks over Tertiary sediments.

In the unit-1 terrain, dynamic metamorphism and small-scale folds suggest complex folding, but the overall structures appear to be anticlines and tight synclines. A thrust fault at the head of Anzac River brings the older schists against Palaeozoic limestone.

The Pinchi fault zone (or related fault zones) extends from Stikine River area southeastward more than 500 miles to Quesnel Lake area. In Fort St. James map-area[6] it has been described as a southwest-dipping major thrust fault in which Permian rocks on the southwest side moved up relative to Mesozoic rocks on the northeast. In McLeod Lake map-area this fault marks the contact between the same two groups of rocks.

The area between the McLeod Lake and Pinchi faults is largely obscured by drift, but available information suggests that several northwest-trending faults, extending in some cases across the area and beyond, slice the rocks into several narrow elongate belts. Many short, subparallel, northeast-trending cross-faults further complicate the structure and disrupt the continuity of these belts.

A little cinnabar has been found in carbonatized and sheared greenstones of the Takla Group northwest of Gordon Lake, generally associated with stringers of quartz. These cinnabar showings are near the Pinchi fault zone, which probably provided channelways for the mineralizing solutions.

A little placer gold has been recovered from Reed Creek, McLeod River, and from streams tributary to Salmon Lake, but not in commercial amounts. Muscovite occurs in books up to 3 inches square in the pegmatites of the Wolverine Complex. Several mineral occurrences are in serpentinized Mississippian(?) rocks north of the western end of Eaglet Lake. Galena, sphalerite, molybdenite, and chalcopyrite are visible and traces of silver, tungsten, and nickel are present. Near the northernmost bend of Fraser River, occurrences of tungsten with traces of lead, gold, and silver have been reported[7]. The deposits consist of scheelite in quartz veins that cut schists and gneisses, of the Wolverine Complex (B). Coarse crystalline magnesite, interbedded with fine-grained dolomite, occurs in 50-foot beds in unit 3 north of Anzac River.

[1] Sutherland Brown, A.: Geology of the Antler Creek Area, Cariboo District, British Columbia; B. C. Dept. Mines, Bull. 38 (1957).
[2] Campbell, R. B.: Quesnel Lake, Cariboo District, British Columbia; Geol. Surv., Canada, P. S. map (in press).
[3] Tipper, H. W.: Prince George, Cariboo District, British Columbia; Geol. Surv., Canada, Map 49-1960 (1961).
[4] Lay, Douglas: Fraser River Tertiary Drainage-history in Relation to Placer-gold Deposits (Part II); B. C. Dept. Mines, Bull. 11 (1941).
[5] Muller, J. E.: Pine Pass, Cariboo and Peace River Districts, British Columbia; Geol. Surv., Canada, Map 11-1961 (1961).
[6] Armstrong, J. E.: Fort St. James Map-area, Cassiar and Coast Districts, British Columbia; Geol. Surv., Canada, Mem. 252 (1949).
[7] B. C. Minister of Mines, Ann. Repts.: 1928, pp. 191-192 (1929); 1935, pp. 30-32 (1936).

MAP 2-1962
McLEOD LAKE
BRITISH COLUMBIA
SHEET 93J